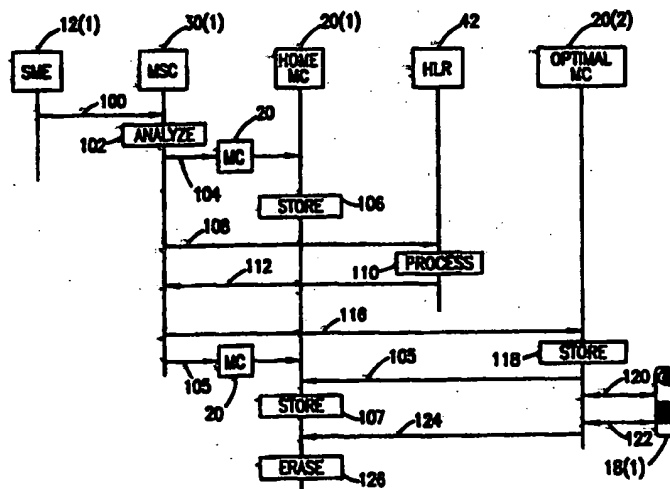




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04Q 7/22		A1	(11) International Publication Number: WO 99/27724
			(43) International Publication Date: 3 June 1999 (03.06.99)
(21) International Application Number: PCT/SE98/02132		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 24 November 1998 (24.11.98)			
(30) Priority Data: 08/979,246 26 November 1997 (26.11.97) US			
(71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).			
(72) Inventors: PATEL, Sonal ; Apartment 43, 4500 De Maison-neuve West, Westmount, Quebec H3Z 1L7 (CA). KATINAKIS, Nikos ; 3620 Ridgewood #604, Montreal, Quebec H3G 1B5 (CA). JOONG, Donald ; 9147 25th Avenue, Montreal, Quebec H1Z 4C7 (CA). RAHMAN, Akbar ; Apartment #106, 2600 Draper Avenue, Ottawa, Ontario K2H 9A9 (CA).			
(74) Agent: ERICSSON RADIO SYSTEMS AB ; Common Patent Dept., S-164 80 Stockholm (SE).		Published With international search report.	

(54) Title: **DISTRIBUTED DATA STORAGE AND DELIVERY IN A CELLULAR TELEPHONE NETWORK**

(57) Abstract

Procedures are disclosed for supporting roaming subscriber mobile station (18) access to stored subscriber data messages. In one aspect, a received subscriber data message is routed for storage and subsequent forwarding/retrieval, not to a "home" message center (20(1)), but instead to a message center (20(2)) either optimally positioned with respect to a current known location of the subscriber mobile station or associated with an initially receiving mobile switching center (30(1)). In another aspect, a mailbox (46) established for a given subscriber mobile station in the home message center is transferred (210), perhaps on a periodic basis, for storage in a local mailbox of a proximate message center within a cellular telephone network (10v) where the subscriber is currently roaming. In either case, the storing message center thereafter performs any requisite operations needed to facilitate message forwarding to or retrieval by the addressee subscriber mobile station.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

DISTRIBUTED DATA STORAGE AND DELIVERY IN A CELLULAR TELEPHONE NETWORK

BACKGROUND OF THE INVENTION

5 Technical Field of the Invention

The present invention relates to cellular telephone networks and, in particular, to the distributed storage and delivery of data associated with cellular telephone network supported subscriber data services (such as short message, facsimile, voice mail and electronic mail delivery).

10 Description of Related Art

Reference is now made to FIGURE 1 wherein there is shown a block diagram of a conventional digital cellular telephone network 10. The network 10 supports one or more subscriber data services (such as short message, facsimile, voice mail and electronic mail delivery) for use by subscribers in conjunction with their conventional
15 cellular telephone service. The purpose of the subscriber data services is to provide a means for transferring subscriber data messages between message entities (MEs) 12 using the communications environment provided by the cellular telephone network 10.

The message entities 12 participating in the subscriber data service comprise data terminals (DTs) 14 connected to the fixed telephone network 16 (comprising a
20 public switched telephone network (PSTN) or other equivalent/similar telephone network). The message entities 12 further comprise the subscriber mobile stations (MS) 18 operating within the cellular telephone network 10. Subscriber data messages must originate with or terminate at one of the subscriber mobile stations 18.

Multiple message centers (MC) 20 are provided and connected to the fixed
25 telephone network 16 and to the cellular telephone network 10. Each message center 20 is a multi-media platform that functions as a store and forward/retrieve center for receiving and delivering subscriber data messages between the message entities 12. When a subscriber data message is originated, it is first sent to a message center 20 associated with that addressor subscriber. The message is then forwarded to another
30 message center 20 associated with the addressee subscriber. At that point, the message

- 2 -

is then delivered to (for example, forwarded to or retrieved by) the addressee message entity at an appropriate time.

The cellular telephone network 10 further includes a plurality of base stations 24 for effectuating radio frequency communications over an air interface 26 with the mobile stations 18. Each base station 24 is connected to a mobile switching center (MSC) 30. The mobile switching center 30 operates to control base station 24 operation, maintain a record (in a home location register 42 and a visitor location register -- not shown) of mobile station 18 operating parameters and location within the network 10 and switch, either within the network 10 or with the fixed telephone network 16, those cellular telephone calls originated by or terminated at the mobile stations 18. The mobile switching centers 30 are further connected to the message centers 20 used in providing the subscriber data services.

A mobile station 18 is typically assigned a "home" message center 20 in much the same way that the mobile station is assigned a home location register 42. It is in this message center 20 that a mailbox 46 assigned to the given mobile station is maintained. Any subscriber data message intended for delivery to that given mobile station 18 passes through, for store and forward/retrieve delivery, the mailbox 46 assigned to and maintained in the associated home message center 20 for that given mobile station. Inefficiencies with this "home" message center 20 based network architecture and topology, however, often arise in connection with roaming mobile stations 18.

First, with respect to message center 20 store and forward operation, all subscriber data messages are initially stored in the home message center (of a home service area within the cellular telephone network 10h) for the addressee roaming subscriber mobile station 18. This message center 20 then must query the home location register 42 for that subscriber mobile station 18 in order to obtain location information, and then attempt to forward the subscriber data message over the network 10 to the roaming subscriber mobile station in a visited service area within the cellular telephone network 10v. Due to latency in updating the location information, or the mobile station being in inactive mode, or congestion in the network or air interface, forwarding of the subscriber data message may fail. Failure of the message forwarding operation results in a waste of valuable network communications resources

- 3 -

and added user/service provider costs. This is especially a problem with subscriber data messages (such as facsimile, voice or the like) which require the establishment of a circuit connection to effectuate delivery.

5 Second, with respect to message center 20 store and retrieve operation, all subscriber data messages are again initially stored in the home message center (of a home service area within the cellular telephone network 10h) for the addressee roaming/moving subscriber mobile station 18. This message center 20 then must then be queried by the roaming subscriber mobile station 18 from the visited service area within the cellular telephone network 10v to collect the stored messages. When
10 roaming, in particular, this querying operation to retrieve messages can be costly and inefficient. This is especially a problem with subscriber data messages (such as facsimile, voice or the like) which require the establishment of a circuit connection to effectuate delivery.

15 What is needed then is a more efficient network architecture and topology for handling stored subscriber data message delivery (either forwarding or retrieval) to roaming/moving subscriber mobile stations.

SUMMARY OF THE INVENTION

20 In a first embodiment of the present invention, the prior art "home" message center network architecture and topology is abandoned in favor of a distributed message center network architecture and topology. In this distributed architecture and topology, a received subscriber data message is routed for storage and subsequent forwarding, not to a "home" message center conventionally provided for an addressee subscriber mobile station, but instead to a message center optimally positioned with respect to the subscriber mobile station or associated with an initially receiving mobile
25 switching center. That optimally positioned message center is identified by querying the home location register for the addressee subscriber mobile station and processing current location information. Following receipt of the subscriber data message, the storing message center performs any requisite operations needed to facilitate message forwarding to the addressee subscriber mobile station.

30 In a second embodiment of the present invention, a mailbox established for a given subscriber mobile station in the home message center is given an optional

- 4 -

portability characteristic implemented when the owning subscriber mobile station is roaming. In such cases, the roaming subscriber mobile station may instruct the establishment of a local mailbox in a proximate message center. The contents (subscriber data messages) of the mailbox maintained in the home message center are then transferred (perhaps additionally on a periodic basis) to the local mailbox. Responsive to any subscriber data messages sent to the mailbox in the home message center thereafter, a notification is then instead given to the addressor of the subscriber data message to make a storage of the message in the local mailbox of the proximate message center. Delivery of the subscriber data messages is then effectuated (through either forwarding or retrieval) by the proximate message center.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be obtained by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

FIGURE 1, previously described in part, is a block diagram of a cellular telephone network;

FIGURE 2 is a message flow and nodal operation diagram illustrating the handling of subscriber data messages in a message center distributed network architecture and topology;

FIGURE 3 is a message flow and nodal operation diagram illustrating an alternative embodiment handling of subscriber data messages in a message center distributed network architecture and topology;

FIGURE 4 is a message flow and nodal operation diagram illustrating yet another alternative embodiment handling of subscriber data messages in a message center distributed network architecture and topology; and

FIGURE 5 is a message flow and nodal operation diagram illustrating mailbox portability within the cellular telephone network of FIGURE 1.

DETAILED DESCRIPTION OF THE DRAWINGS

1. Distributed Architecture and Topology

Reference is now made, in combination with FIGURE 1, to FIGURE 2 wherein there is shown a message flow and nodal operation diagram illustrating the handling of subscriber data messages in a message center distributed network architecture and topology. A subscriber data message 100 is generated by an addressor message entity 12(1) and received by a (gateway or originating) mobile switching center 30(1) of the cellular telephone network. The mobile switching center 30(1) analyzes the addressee information for the subscriber data message 100 in action 102, and using an appropriate address look-up mechanism/process, identifies a "home" message center 20(1) associated with an addressee subscriber mobile station 18(1) that is the destination of the subscriber data message.

In accordance with known prior art message handling procedures, the received subscriber data message 100 is forwarded 104 to the identified "home" message center 20(1) for the addressee subscriber mobile station 18(1) through a message center 20 associated with the short message entity 12(1) and stored (action 106). By "home" it is meant that message center 20(1) assigned to and maintained by a service provider to which the addressee subscriber mobile station 18(1) has subscribed for telephone service. Storage 106 in the home message center 20(1) provides a back-up copy of the message 100 in the event it is later needed. This procedure for backing-up the subscriber data message 100 in the home message center 20(1) is, however, optional in accordance with the present invention.

Contrary to conventional practice, no attempt is made by the home message center 20(1) in the present invention to deliver (for example, forward) the stored message to the addressee subscriber mobile station 18(1). The reason for this is that the home message center 20(1) recognizes, either from an indication supplied by the mobile switching center 30(1) in the message forward 104, or by querying the home location register 42 (not shown), that another, optimally positioned, message center has also been sent the message for attempted delivery.

In accordance with a distributed architecture and topology implemented in connection with the present invention, the mobile switching center 30(1) further queries 108 the identified home location register 42 for the current location of the

- 6 -

addressee subscriber mobile station 18(1). The home location register 42 processes the query 108 in action 110 to identify the current location and identify an optimally positioned message center 20(2) based on location, and then returns 112 pointer information for that optimal message center back to the mobile switching center 30(1).
5 This optimally positioned message center 20(2) may comprise that message center which is most proximate to the current location of the addressee subscriber mobile station 18(1). Using the returned pointer information, the mobile switching center 30(1) then forwards 116 the message 100 to the identified message center 20(2) proximate to the addressee subscriber mobile station 18(1) for storage (action 118).
10 It is based on this identification of an optimal message center 20(2) that the mobile switching center 30(1) may provide the indication to the home message center 20(1) (referenced above in the forward 104) not to attempt delivery. Following storage 118 of the forwarded 116 subscriber data message 100, conventional forwarding 120 procedures well known to those skilled in the art are implemented to effectuate message delivery to the addressee subscriber mobile station 18(1). As an alternative,
15 appropriate conventional retrieval 122 procedures may also be supported for message delivery.

As an alternative to actually backing-up (see, message 104 and action 106) the message 100 in the home message center 20(1), the mobile switching center 30(1) may
20 instead signal 105 the home message center (through message center 20) with data relating to the subscriber data message 100. This data, which does not comprise the message 100 itself, is then stored by the home message center 20(1) in action 107. The data in signal 105 specifies not only the type of subscriber data message 100 that was received, but also identifies the optimal message center 20(2) to which the
25 message was forwarded 116 for storage 118 and attempted delivery (120 or 122). Other data specific and tailored to the received subscriber data message may also be stored. For example, for a facsimile message, the number of pages in the facsimile, time of receipt, and party identifications may be noted. For a voice mail message, calling party identification and time of call may be noted. As a further alternative to
30 origination from the mobile switching center 30(1), the signal 105 may instead be generated at and sent from the optimal message center 20(2) to the home message center 20(1), followed by data storage 107.

- 7 -

If the delivery 120 or 122 is successful, a message 124 indicative of such is sent to the home message center 20(1) so that the previously stored 106 message, or previously stored 107 message data, may be erased (action 126). This message 124 may further provide the home message center 20(1) with charging information relating to the store and forward/retrieve operation effectuated for message delivery.

Reference is now made, in combination with FIGURE 1, to FIGURE 3 wherein there is shown a message flow and nodal operation diagram illustrating an alternative embodiment handling of subscriber data messages in a message center distributed network architecture and topology. A subscriber data message 100 is generated by an addressor message entity 12(1) and received by a receiving mobile switching center 30(1) of the cellular telephone network. The mobile switching center 30(1) analyzes the addressee information for the subscriber data message 100 in action 102, and using an appropriate look-up mechanism/process, identifies a home location register 42 associated with an addressee subscriber mobile station 18(1) that is the destination of the subscriber data message.

In accordance with known prior art message handling procedures, the received subscriber data message 100 is forwarded 104 to the identified "home" message center 20(1) for the addressee subscriber mobile station 18(1) through a message center 20 associated with the short message entity 12(1) and stored (action 106). By "home" it is meant that message center 20(1) assigned to and maintained by a service provider to which the addressee subscriber mobile station 18(1) has subscribed for telephone service. Storage 106 in the home message center 20(1) provides a back-up copy of the message 100 in the event it is later needed. This procedure for backing-up the subscriber data message 100 in the home message center 20(1) is, however, optional.

Contrary to conventional practice, no attempt is made by the home message center 20(1) in the present invention to deliver (for example, forward) the stored message to the addressee subscriber mobile station 18(1). The reason for this is that the home message center 20(1) recognizes, either from an indication supplied by the mobile switching center 30(1) in the message forward 104, or by querying the home location register 42 (not shown), that another, optimally positioned, message center has also been sent the message for attempted delivery.

In accordance with a distributed architecture and topology implemented in connection with the present invention, the receiving mobile switching center 30(1) identifies in action 114 through an appropriate look-up mechanism or process a message center 20(2) that is associated with the receiving mobile switching center. The received subscriber data message 100 is then forwarded 116 to the identified message center 20(2) associated with the receiving mobile switching center 30(1) and stored (action 118). It is based on this identification of the associated message center 20(2) that the receiving mobile switching center 30(1) may provide the indication to the home message center 20(1) (referenced above in the forward 104) not to attempt delivery. Following storage 118 of the forwarded 116 subscriber data message 100, conventional forwarding 120 procedures well known to those skilled in the art are implemented to effectuate message delivery to the addressee subscriber mobile station 18(1). As an alternative, appropriate conventional retrieval 122 procedures may also be supported for message delivery.

As an alternative to actually backing-up (see, message 104 and action 106) the message 100 in the home message center 20(1), the mobile switching center 30(1) may instead signal 105 the home message center (through message center 20) with data relating to the subscriber data message 100. This data, which does not comprise the message 100 itself, is then stored by the home message center 20(1) in action 107. The data in signal 105 specifies not only the type of subscriber data message 100 that was received, but also identifies the associated message center 20(2) to which the message was forwarded 116 for storage 118 and attempted delivery (120 or 122). Other data specific and tailored to the received subscriber data message may also be stored. For example, for a facsimile message, the number of pages in the facsimile, time of receipt, and party identifications may be noted. For a voice mail message, calling party identification and time of call may be noted. As a further alternative to origination from the mobile switching center 30(1), the signal 105 may instead be generated at and sent from the associated message center 20(2) to the home message center 20(1), followed by data storage 107.

If the delivery 120 or 122 is successful, a message 124 indicative of such is sent to the home message center 20(1) so that the previously stored 106 message, or previously stored 107 message data, may be erased (action 126). This message 124

may further provide the home message center 20(1) with charging information relating to the store and forward/retrieve operation effectuated for message delivery.

Reference is now made, in combination with FIGURE 1, to FIGURE 4 wherein there is shown a message flow and nodal operation diagram illustrating yet another alternative embodiment handling of subscriber data messages in a message center distributed network architecture and topology. A subscriber data message 100 is generated by an addressor message entity 12(1) and received by a receiving mobile switching center 30(1) of the cellular telephone network. The receiving mobile switching center 30(1) analyzes the addressee information for the subscriber data message 100 in action 102, and using an appropriate look-up mechanism/process, identifies a home location register 42 associated with an addressee subscriber mobile station 18(1) that is the destination of the subscriber data message, and further identifies a message center 20(1) that is associated with the receiving mobile switching center.

The received subscriber data message 100 is then forwarded 128 to the identified message center 20(1) associated with the receiving mobile switching center 30(1) and stored (action 130). Storage 106 in the home message center 20(1) provides a back-up copy of the message 100 in the event it is later needed. This procedure for backing-up the subscriber data message 100 in the home message center 20(1) is, however, optional.

No attempt is made by the associated message center 20(1) to deliver (through either forward or retrieve) the stored message to the addressee subscriber mobile station 18(1). The reason for this is that the associated message center 20(1) recognizes, either from an indication supplied by the receiving mobile switching center 30(1) in the message forward 104, or by querying the home location register 42 (not shown), that another, optimally positioned, message center has also been sent the message for attempted delivery.

In accordance with a distributed architecture and topology implemented in connection with the present invention, the mobile switching center 30(1) further queries 108 the identified home location register 42 for the current location of the addressee subscriber mobile station 18(1). The home location register 42 processes the query 108 in action 110 to identify the current location and identify an optimally

- 10 -

positioned message center 20(2), and then returns 112 pointer information for that optimal message center back to the mobile switching center 30(1). This optimally positioned message center 20(2) may comprise that message center which is most proximate to the current location of the addressee subscriber mobile station 18(1).

5 Using the returned pointer information, the mobile switching center 30(1) then forwards 116 the message 100 to the identified message center 20(2) proximate to the addressee subscriber mobile station 18(1) for storage (action 118). It is based on this identification of an optimal message center 20(2) that the mobile switching center 30(1) may provide the indication to the home message center 20(1) (referenced above
10 in the forward 104) not to attempt delivery. Following storage 118 of the forwarded 116 subscriber data message 100, conventional forwarding 120 procedures well known to those skilled in the art are implemented to effectuate message delivery to the addressee subscriber mobile station 18(1). As an alternative, appropriate conventional retrieval 122 procedures may also be supported for message delivery.

15 As an alternative to actually backing-up (see, message 128 and action 130) the message 100 in the associated message center 20(1), the mobile switching center 30(1) may instead signal 105 the associated message center with data relating to the subscriber data message 100. This data, which does not comprise the message 100 itself, is then stored by the associated message center 20(1) in action 107. The data
20 in signal 105 specifies not only the type of subscriber data message 100 that was received, but also identifies the optimal message center 20(2) to which the message was forwarded 116 for storage 118 and attempted delivery (120 or 122). Other data specific and tailored to the received subscriber data message may also be stored. For example, for a facsimile message, the number of pages in the facsimile, time of receipt, and party identifications may be noted. For a voice mail message, calling
25 party identification and time of call may be noted. As a further alternative to origination from the mobile switching center 30(1), the signal 105 may instead be generated at and sent from the optimal message center 20(2) to the associated message center 20(1), followed by data storage 107.

30 If the delivery 120 or 122 is successful, a message 124 indicative of such is sent to the associated message center 20(1) so that the previously stored 130 message, or previously stored 107 message data, may be erased (action 132). This message 124

- 11 -

may further provide the associated message center 20(1) with charging information relating to the store and forward/retrieve operation effectuated for message delivery.

With respect to FIGURES 2, 3 and 4, different types of network transport connections may be utilized in order to implement the various recited message forwarding (104, 105, 116 or 128) or delivery (120 or 122) actions. For example, if the subscriber data message comprises a short message service (SMS) data message, excess capacity in the Signaling System No. 7 (SS7) network (not shown explicitly in FIGURE 1) is used for message transport within the network, and a control signaling channel is used on the air interface for communication with the addressee mobile station 18(1). Similar transport could be effectuated for electronic mail type data messages. If the subscriber data message instead comprises a facsimile data message, a circuit switched connection (not shown explicitly in FIGURE 1) is used for message transport within the network, and a traffic channel is used on the air interface for communication with the addressee mobile station 18(1). Similar transport could be effectuated for voice mail type data messages. The network service provider and/or subscriber may specify whether the charges for use of the network transport resources are to be billed to the addressor message entity 12(1) or the addressee subscriber mobile station 18(1).

2. Mailbox Portability

Reference is now once again made to FIGURE 1. Each message entity 12 is associated with both a "home" message center 20 of the home service area within the cellular telephone network 10h and a mailbox 46 maintained within that message center. It is in this mailbox 46 that subscriber data messages sent by or sent to the particular message entity 12 are stored. Mobile stations 18 are message entities 12 capable of movement. In most cases, movement of the mobile station, for example within its own home cellular telephone network 10h, does not present any particular difficulties with respect to the maintenance of the mailbox 46 and the sending or delivery of stored subscriber data messages.

Movement comprising roaming within a visited cellular telephone network 10v, on the other hand, does present some problems. While roaming within the visited cellular telephone network 10v, subscriber data messages for a given subscriber mobile station 18 continue to be saved in the home message center 20. In order to

- 12 -

retrieve these messages, the mobile station 18 must make contact with the home message center 20. If delivery (forwarding or retrieval) of the stored subscriber data messages requires use of a circuit connection (such as with facsimile or voice mail messages), long distance calling charges are incurred.

5 In accordance with the present invention, the roaming subscriber establishes a local mailbox 46' in a proximate message center 20 associated with the visited cellular telephone network 10v. The stored contents of the home mailbox 46 associated with the home cellular telephone network 10h are then transferred over a connecting network 50 for storage in the local mailbox 46'. Any subsequently
10 received subscriber data messages are similarly transferred from the home mailbox 46 to the local mailbox 46' over the connecting network 50. Charges for effectuating the transfer of stored data over the network 50 are borne by the roaming subscriber. An appropriate announcement and acceptance procedure is implemented to confirm charging and allow for transport network selection. Furthermore, where appropriate,
15 subscriber data messages destined for storage in the home mailbox 46 are intercepted by a mobile switching center 30 in the home cellular telephone network 10h, and redirected to the local mailbox 46' for storage. In these instances, charges for effectuating the redirection are borne by the party sending/leaving the subscriber data message for the roaming subscriber. Again, an appropriate announcement and
20 acceptance procedure is implemented to confirm charging and allow for transport network selection.

The type of connecting network 50 used for effectuating the transfer or redirection of the subscriber data messages differs depending on the type of message traffic at issue. For example, for short message service (SMS) messages, or perhaps
25 electronic mail messages, excess capacity on the Signaling System No. 7 (SS7) network may be used. Other types of transport networks, such as a cellular digital packet data (CDPD), X.25, asynchronous transfer mode (ATM), integrated service digital network (ISDN), public switched telephone network (PSTN), internet (TCP/IP) or the like network, may also be used for the transfers and redirections implicating
30 more intensive data transmission or circuit connection requiring transactions.

Reference is now made, in combination with FIGURE 1, to FIGURE 5 wherein there is shown a message flow and nodal operation diagram illustrating

- 13 -

mailbox portability within the cellular telephone network of FIGURE 1. When a roaming subscriber mobile station 18(2) initially registers 200 within a visited cellular telephone network 10v, the network, in conjunction with defining a service profile for and connecting a roamer directory number to the roaming mobile station (action 202),
5 further defines and establishes (action 204) a local mailbox 46' for that subscriber in an associated message center 20(1). Following such initial definition and establishment, the associated message center 20(1) uses the network 50 to contact 206 a home message center 20(2) for that subscriber mobile station 18(2). Responsive to the contact 206, the home message center extracts any subscriber data messages stored
10 in the mailbox 46 (action 208). These extracted messages are then transmitted 210 back over the network 50 to the associated message center 20(1), and stored (action 212) in the local mailbox 46'. A record 214 is kept by the home message center 20(2) of the current location of the mailbox 46' for the roaming subscriber mobile station 18(2). Any subsequently received mailbox 46 stored subscriber data messages may
15 thereafter be periodically extracted 216 (for example, through polling) from the mailbox 46, transmitted 218 over the network to the associated message center 20(2), and stored 220 in the local mailbox 46'. Alternatively, the home location register 20 (see, FIGURE 1) stores information pointing to the current location of the mailbox 46' for the roaming subscriber mobile station 18(2). Any subsequently received subscriber
20 data messages are then re-directed 218 over the network following home location register querying to the associated message center 20(2), and stored 220 in the local mailbox 46'. Once stored in the local mailbox 46', conventional forwarding 222 or retrieval 224 procedures well known to those skilled in the art (such as short message service (SMS) delivery, voice mail, large file delivery, and the like) are implemented
25 to effectuate message delivery to the addressee roaming subscriber mobile station 18(2).

It will be understood that the transmission 210 or 218 of each stored subscriber data message over the network 50 may require the use of one or more different types of networks tailored for the specific type of message being sent. For example, one
30 type of subscriber data message, such as a voice mail or facsimile message, may be sent over a circuit connection through an integrated service digital network (ISDN) or public switched telephone network (PSTN). Another type of subscriber data message,

- 14 -

such as a short message service or electronic mail message, may be sent over a connection-less transport using a Signaling System No. 7 (SS7), internet (TCP/IP), cellular digital packet data (CDPD), X.25, or asynchronous transfer mode (ATM) network. The contact 206 accordingly includes, and the record 214 accordingly stores, addressing information which would enable the home message center 20(2) to address communications transmissions 210 and 218 (comprising the extracted subscriber data messages) over a selected appropriate one of the various types of networks supported by the network 50 for message delivery to the associated message center 20(1).

The addressing information stored in the record 214 is further made available to a serving mobile switching center 30 in those instances where an addressor message entity desires to leave a message 226 for (or send a message to) the roaming subscriber mobile station. With the addressing information, and responsive to addressor approval for a transfer, the serving mobile switching center may route 228 the data service message 226, which conventionally would have been stored in the mailbox 46 of the home message center 20(2), instead through the network 50 to the associated message center 20(1) for storage 230 in the local mailbox 46'. Charges for this transmission 228 are, from the perspective of the roaming subscriber mobile station 18(2), advantageously borne by the addressor. For this implementation, either the home message center 20(2) or the originating (gateway) mobile switching center 30 provides the prompting announcement to the addressor, and collects a confirmation concerning charging and perhaps transport network selection.

Although embodiments of the method and apparatus of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

-15-

WHAT IS CLAIMED IS:

1. A method for handling storage of subscriber data messages within a cellular telephone network, comprising the steps of:
 - receiving a subscriber data message transmitted to an addressee message entity;
 - 5 forwarding the received subscriber data message, not to a home message center associated with the addressee message entity, but instead to another message center;
 - storing the forwarded subscriber data message in the other message center; and
 - delivering the stored subscriber data message to the addressee message entity
 - 10 from the other message center.
2. The method as in claim 1 wherein the other message center comprises a message center assigned to a switching node of the cellular telephone network which initially received the subscriber data message transmitted to the addressee message entity.
- 15 3. The method as in claim 2 further including the step of sending a notification of subscriber data message forwarding to the home message center, the notification sent from the receiving switching node.
4. The method as in claim 2 further including the step of sending a notification of subscriber data message forwarding to the home message center, the
- 20 notification sent from the other message center.
5. The method as in claim 1 wherein the other message center comprises a message center proximate to a current location within the cellular telephone network of the addressee message entity.
6. The method as in claim 5 further comprising the steps of:
 - 25 querying a location database to determine an approximate location of the addressee message entity; and
 - processing the approximate location to identify the proximate message center.

- 16 -

7. The method as in claim 5 further including the step of sending a notification of subscriber data message forwarding to the home message center, the notification sent by the proximate message center.

5 8. The method as in claim 1 further including the step of sending a notification of subscriber data message forwarding to the home message center, the notification sent by a switching node of the cellular telephone network which initially received the subscriber data message transmitted to the addressee message entity and forwarded the subscriber data message to the other message center.

10 9. The method as in claim 1 wherein the addressee message entity comprises a roaming subscriber mobile station.

10. A wireless telephone network, comprising:
a first message center assigned to a service provider to which an addressee message entity has subscribed for telephone service;
a second message center;
15 a switching node having connection capability with both the first and the second message center, the switching node receiving a subscriber data message addressed to the addressee message entity and operating to forward the received subscriber data message not to the first message center but instead to the second message center.

20 11. The network as in claim 10 wherein the second message center is assigned to a service provider providing telephone service through the switching node.

12. The network as in claim 10 wherein the second message center is proximately located to a current location of the addressee message entity.

25 13. The network as in claim 10 wherein the addressee message entity comprises a subscriber mobile station.

- 17 -

14. The network as in claim 10 wherein the first message center comprises a home message center for the addressee message entity.

15. The network as in claim 10 wherein the switching node further operates to notify the first message center of the forwarding of the subscriber data message to the second message center.

16. The network as in claim 10 wherein the second message center operates to effectuate delivery of the forwarded subscriber data message to the addressee message entity.

17. The network as in claim 10 wherein the second message center operates to notify the first message center of the forwarding of the subscriber data message to the second message center.

18. A method for providing message center portability, comprising the steps of:

15 establishing a mailbox for a given message entity in a home message center; responsive to a roamer registration of the given message entity establishing a local mailbox in a visited message center; and transferring stored subscriber data message contents of the mailbox in the home message center for storage in the local mailbox of the visited message center.

19. The method as in claim 18 wherein the message entity comprises a subscriber mobile station operable within a cellular telephone network.

20. The method as in claim 18 wherein the step of transferring comprises the step of periodically transferring stored subscriber data message contents to the local mailbox.

-18-

21. The method as in claim 18 further including the step of redirecting attempts to store subscriber data contents in the mailbox of the home message center instead to the local mailbox of the visited message center.

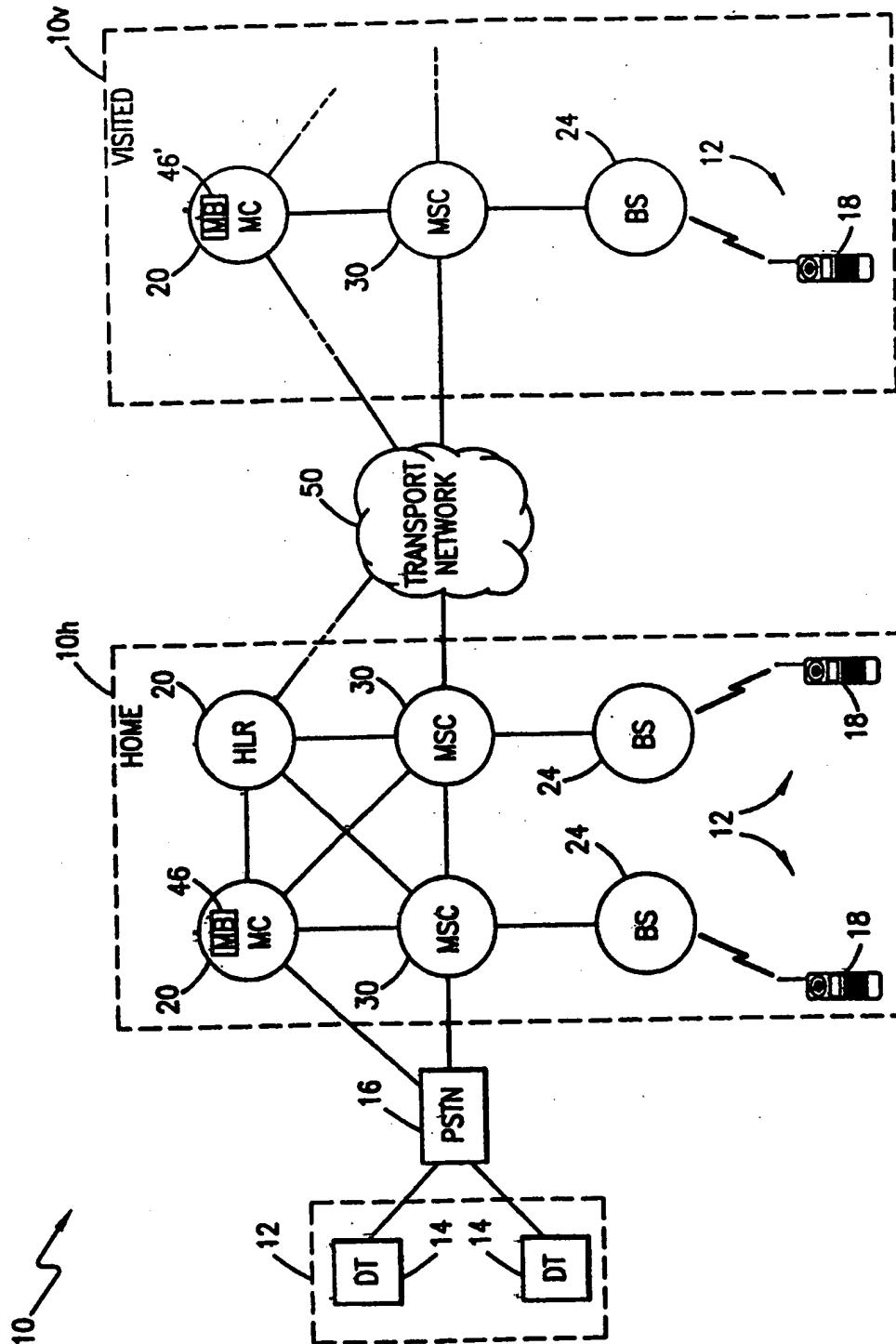
5 22. The method as in claim 18 wherein the step of transferring comprises the steps of confirming transfer and allowing for selection of a particular transport network to carry the subscriber data.

23. A wireless telephone network, comprising:
a first message center assigned to a service provider to which an addressee message entity has subscribed for telephone service;
10 a mailbox provided in the first message center for storing addressee message entity subscriber data messages;
a second message center assigned to a service provider offering roamer telephone service to the addressee message entity;
a local mailbox in the second message center for storing addressee message
15 entity subscriber data messages when roaming; and
a network connection between the first and second message center for transferring the addressee message entity subscriber data messages stored in the mailbox of the first message center for storage in the local mailbox of the second message center while the addressee message entity is roaming.

20 24. The network as in claim 23 wherein the message entity comprises a subscriber mobile station operable within a cellular telephone network.

25. The network as in claim 23 further including a home location register storing information pointing to the second message center as having the local mailbox for the subscriber mobile station.

FIG. 1



2 / 3

FIG. 2

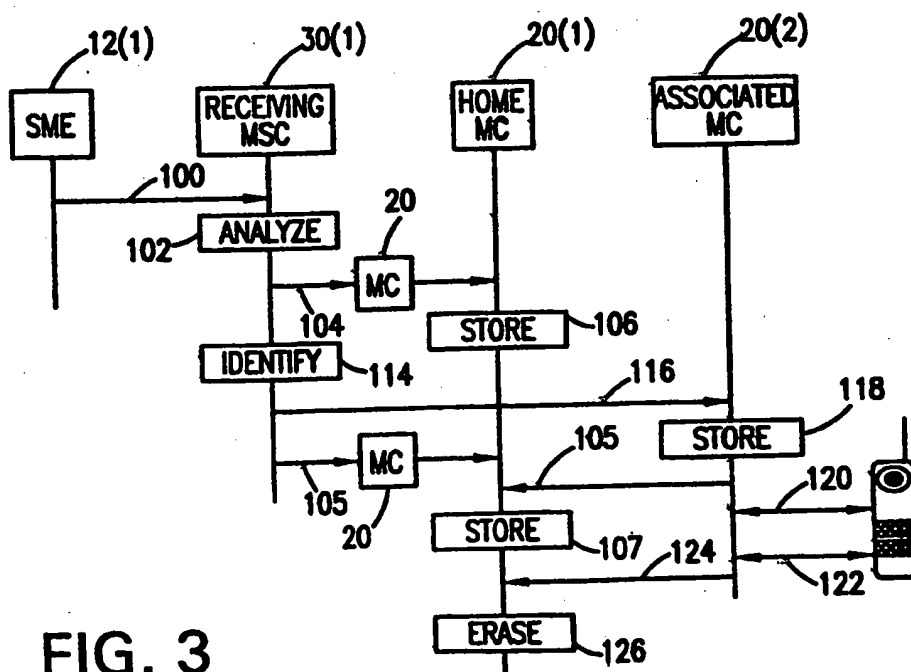
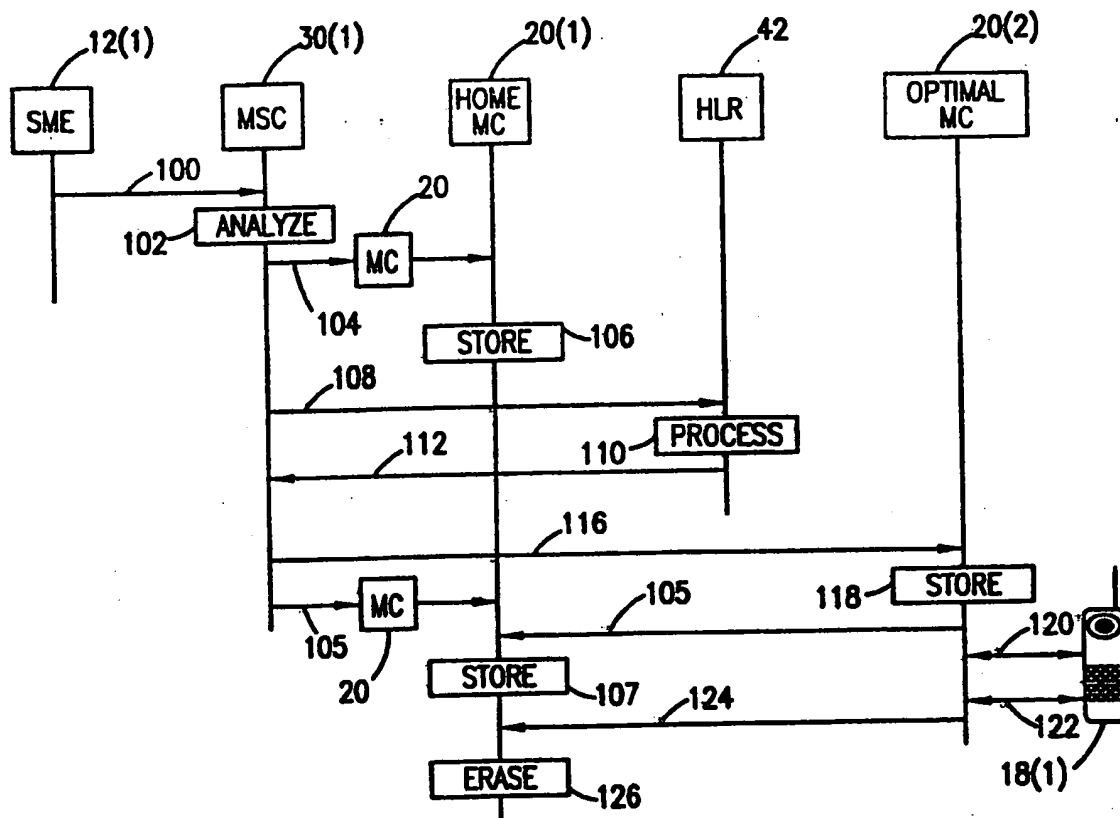


FIG. 3

FIG. 4

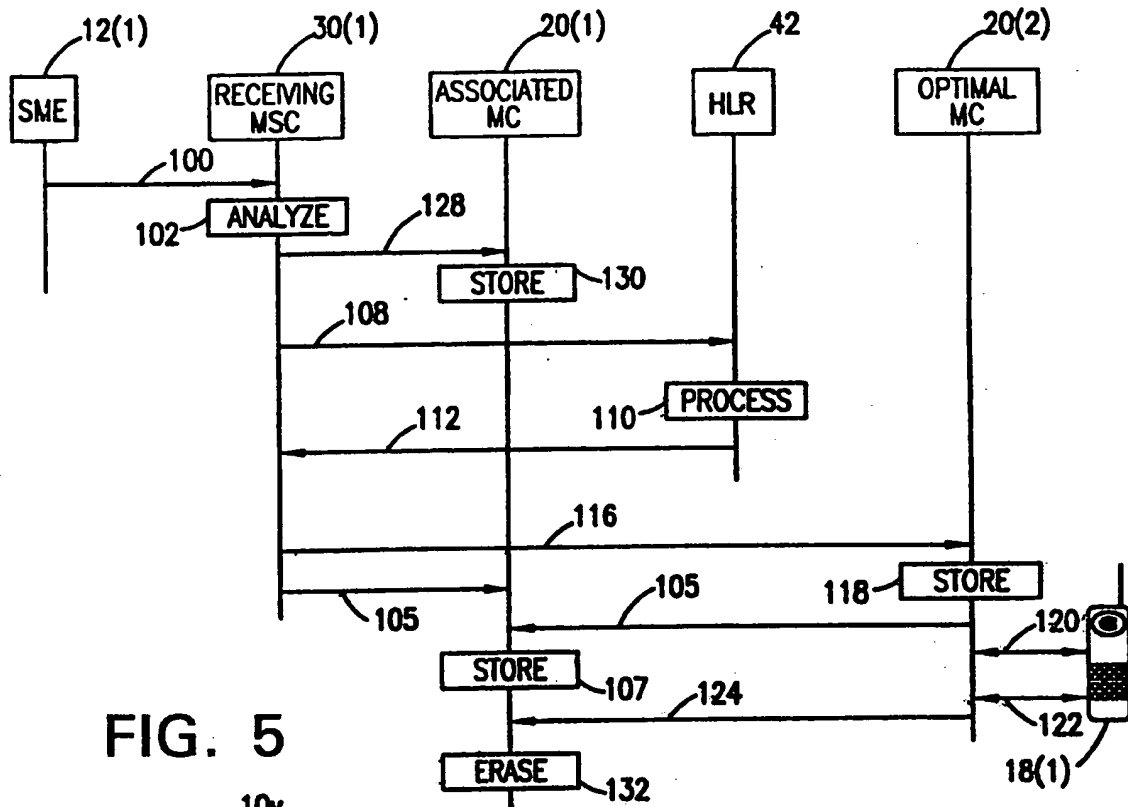
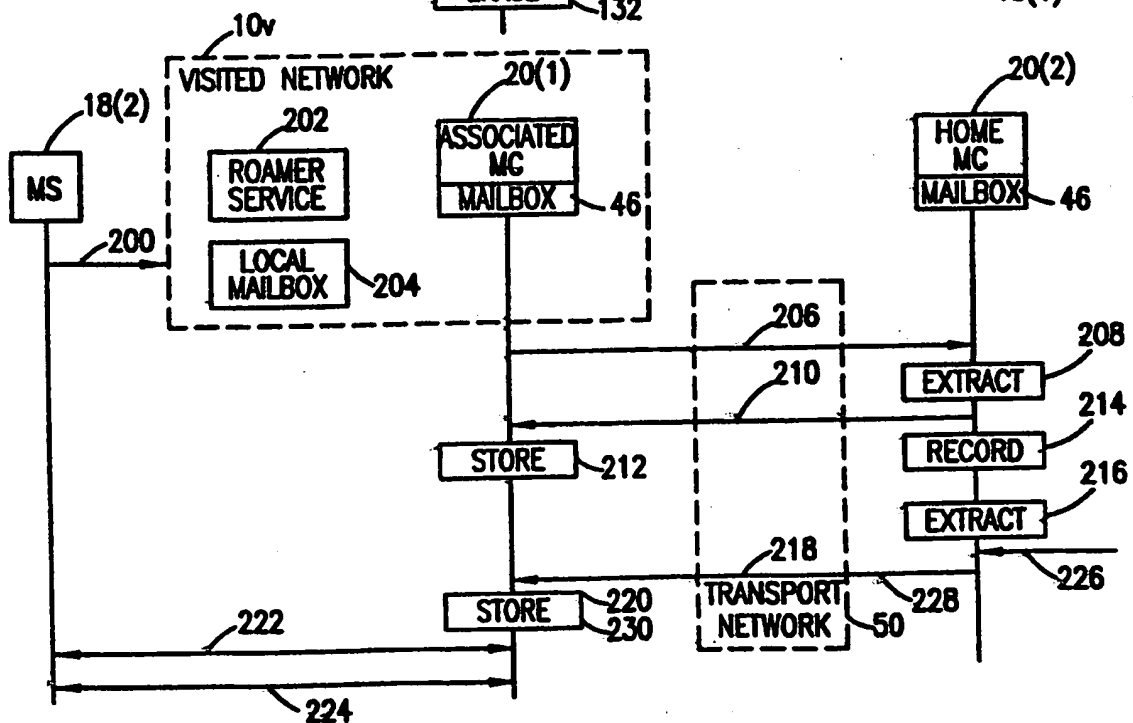


FIG. 5



INTERNATIONAL SEARCH REPORT

In Application No
PCT/SE 98/02132

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04Q7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04M H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 682 457 A (TECNOMEN OY) 15 November 1995 see column 1, line 55 - line 58 see column 3, line 23 - column 4, line 4	10, 12-20, 22-25
P, X	EP 0 820 181 A (AT & T CORP) 21 January 1998 see claim 8	10, 12-20, 22-25
A	WO 97 11564 A (MOTOROLA INC) 27 March 1997 see page 7, line 12 - page 8, line 29	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "A" document member of the same patent family

Date of the actual completion of the international search

10 February 1999

Date of mailing of the international search report

17/02/1999

Name and mailing address of the ISA
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Leouffre, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inventor Application No

PCT/SE 98/02132

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0682457 A	15-11-1995	FI 942219 A US 5627877 A	14-11-1995 06-05-1997
EP 0820181 A	21-01-1998	US 5751792 A CA 2207657 A JP 10079794 A	12-05-1998 15-01-1998 24-03-1998
WO 9711564 A	27-03-1997	US 5666107 A AU 6676696 A CA 2232300 A CN 1196810 A EP 0852099 A	09-09-1997 09-04-1997 27-03-1997 21-10-1998 08-07-1998